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ABSTRACT

A study investigated the effect of phonemic awareness and cognitive flexibility training on the phonemic awareness, cognitive flexibility, reading, and spelling ability of kindergarten and first-grade students. Subjects were 280 students from 12 classrooms in 3 urban elementary schools. Four pre- and posttest measures were administered. Students in each classroom were randomly assigned to one of two treatment conditions: cognitive flexibility training followed by phonemic awareness training; or phonemic awareness training only. During the first 5 weeks of the 10-week intervention, students and teachers in the first group participated in fun, game-like problem solving tasks and activities that fostered divergent thinking. Students in the second group listened to stories read aloud by the teacher. During the second 5 weeks, all students received identical, whole-group phonemic awareness training. Results indicated significant correlations between cognitive flexibility and phonemic awareness, cognitive flexibility and growth in reading comprehension, and cognitive flexibility and spelling ability, especially among children with low cognitive flexibility scores. Findings suggest that increased cognitive flexibility (the ability to retrieve and use information from a variety of knowledge bases to construct situational meaning in a complex knowledge domain) may strengthen the effectiveness of phonemic awareness, reading, and spelling instruction for kindergarten and first-grade students with low cognitive flexibility. (Eight unnumbered charts of data are attached.) (RS)

Title: Effects of cognitive flexibility and phonemic awareness training on kindergarten and first-grade students' phonemic awareness, cognitive flexibility, reading, and spelling ability.

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a. Purpose

This study investigates the effect of phonemic awareness and cognitive flexibility training on the phonemic awareness, cognitive flexibility, reading and spelling ability of kindergarten and first-grade students (N = 280). The purpose of the study is to determine if children trained in cognitive flexibility and phonemic awareness in kindergarten and first grade will differ in cognitive flexibility, phonemic awareness, reading and developmental spelling ability from children who receive only phonemic awareness training. The study addresses the following questions: (a) Is cognitive flexibility related to phonemic awareness, reading, and spelling ability? (b) Does cognitive flexibility training in conjunction with phonemic awareness training significantly improve phonemic awareness, cognitive flexibility, reading and spelling ability? (c) Do changes in cognitive flexibility correspond to improvements in phonemic awareness, reading and spelling ability? and (d) Do the relationships between cognitive flexibility and phonemic awareness, reading, and spelling ability depend on degree of cognitive flexibility? Research examining the relationships among students' cognitive flexibility, phonemic awareness, reading and spelling ability may provide insight into cognitive flexibility as a factor associated with early literacy skills.

b. Theoretical Framework

Phonemic awareness is related to successful reading and spelling acquisition (Byrne & Fielding-Barnsley, 1991). Children with minimal phonemic awareness skills can be trained and the training often results in improved phonemic skills, reading, and/or spelling ability (Ball & Blachman, 1990; Cunningham, 1986; Dewitz & Guinessy, 1990; Dewitz, Skilliter, Kobberman, & McKeown, 1989; Ehri, 1989; Griffith, 1991; Lie, 1991; O'Connor, 1990; Rosner, 1974; Slocum, 1991; Tangel & Blachman, 1995).

However, phonemic awareness training does not always result in improved phonemic awareness and reading achievement for low-ability primary students. Results of a recent study with low- and middle-ability first-graders (Weiner, 1994) suggest that (a) phonemic awareness training

may not be responsible for changed phonemic awareness, word identification or reading ability; and (b) training type ("skill & drill" vs. complex instruction linking phonemic awareness, word identification and reading) may interact with ability. Weiner (1994) found that the more complex training proved particularly difficult or confusing for low-ability readers.

Presumably, there are multiple factors specific to the development of phonemic awareness and early literacy skills for low-ability students. Cognitive flexibility theory suggests one possibility why the complex training may not have been successful. Spiro, Vispoel, Schmitz, Samarapungavan, & Boerger (1987) propose that information from different knowledge sources is needed to construct meaning in a complex knowledge domain (e.g. reading acquisition). An approach to early literacy instruction that is informed by the theory of cognitive flexibility includes emphasis on multiple alternative systems of linkage among knowledge elements (e.g. sounds, words, patterns, ideas, etc.); multiple cases of application; participatory learning; and adequate scaffolding for managing the complexity. Similarly, student learning that is facilitated by cognitive flexibility involves the ability to select diverse knowledge elements to fit the needs of understanding and decision-making in a specific literacy episode (e.g. reading, spelling, etc.). If, by definition, literacy represents a complex knowledge domain, and literacy learning necessitates access to and use of knowledge within this domain, it is possible that limited or no cognitive flexibility, in conjunction with ability, may interact with the effectiveness of emergent literacy instruction for some students. If so, it may be necessary to (a) identify and (b) provide cognitive flexibility instruction for students unfamiliar with this type of thinking in this type of knowledge domain.

c. Method

Subjects. Kindergarten and first-grade students from twelve classrooms in three urban elementary schools participated in the study (N = 280). All subjects passed vision and hearing screening tests conducted by school personnel. Each participating primary teacher teaches reading using a similar, district adopted, phonics-based reading program for approximately 90 minutes per day.

Instruments. Four pre- and post- measures were administered: a five-item, complex phonemic awareness test (substitution and deletion) (Weiner, 1994); a one-item cognitive flexibility test ("Instances") (Wallach & Kogan, 1965); an informal reading comprehension test (Elster, 1995); and a six-item, developmental spelling test (Tangel & Blachman, 1995). All measures, with the exception of the developmental spelling test, were administered individually. In general, no measure took more than five minutes to administer.

Procedures. Students in each classroom were randomly assigned to one of two treatment conditions: (a) cognitive flexibility training followed by phonemic awareness training (Group 1), or (b) phonemic awareness training only (Group 2). During the first five weeks of the ten-week intervention,

the students and teachers in Group 1 (receiving cognitive flexibility training), participated in fun, game-like problem-solving tasks and activities that foster divergent thinking. Teachers provided explicit modeling and instruction relative to the importance of using knowledge elements from divergent sources to think about and solve problems. During this same five-week period, the students in Group 2 (receiving no cognitive flexibility training) participated in a placebo activity (i.e. listening to stories read aloud by the classroom teacher). During the second five weeks, all students (Group 1 and 2) received identical, whole-group phonemic awareness training that consisted of various phonological awareness activities involving the recognition, generation and manipulation of syllables, onsets, rimes, and phonemes. These activities are fun, game-like songs and wordplay (Yopp, 1992; Lundberg, Frost, & Peterson, 1988). All training was administered by the classroom teacher to each treatment group during three, 20-minute sessions each week. Following the intervention, all tests were repeated.

d. Data Analysis and Preliminary Results

Results indicate significant correlations between cognitive flexibility and phonemic awareness, cognitive flexibility and growth in reading comprehension, and cognitive flexibility and spelling ability, especially among children with low cognitive flexibility scores. Analysis of variance (ANOVA), with repeated measures, revealed that both groups grew in cognitive flexibility (F (1, 190) = 11.6; p>.05). However, the improvement was significantly greater among the children who received cognitive flexibility training (F (1, 190) = 6.7; p<.05). Among children with initial, low cognitive flexibility scores, growth in cognitive flexibility was positively correlated with post phonemic awareness scores (r = .36; p<.01); growth in reading comprehension (r = .74; p<.05); and post spelling scores (r = .28; p<.05). These correlations were not significant among children with initial, high cognitive flexibility scores. These results indicate that cognitive flexibility is significantly related to phonemic awareness, reading, and spelling ability in the absence of training. Cognitive flexibility training is effective for low-cognitive flexibility children and greater gains in cognitive flexibility are associated with higher phonemic awareness and spelling scores and growth in reading for these children.

e. Educational Importance of the Study

Increased cognitive flexibility (i.e. the ability to retreive and use information from a variety of knowledge bases to construct situational meaning in a complex knowledge domain) may strengthen the effectiveness of phonemic awareness, reading and spelling instruction for kindergarten and first-grade students with low cognitive flexibility. New understandings of these complex relationships may result in meaningful contributions to the literature on literacy acquisition and, it is hoped, the informed diagnosis and subsequent instruction of students experiencing difficulty learning to read and spell.

f. Key References

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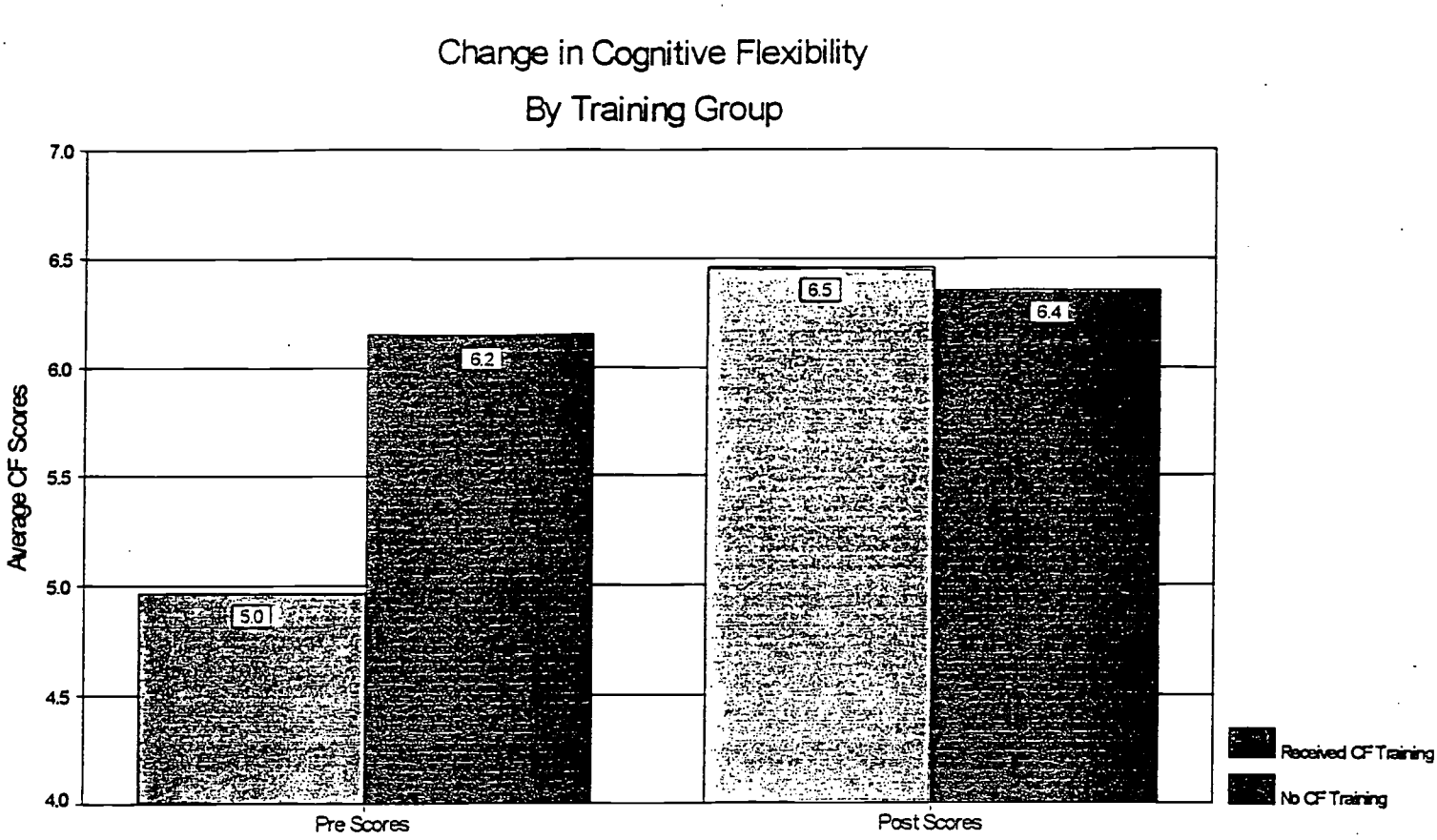
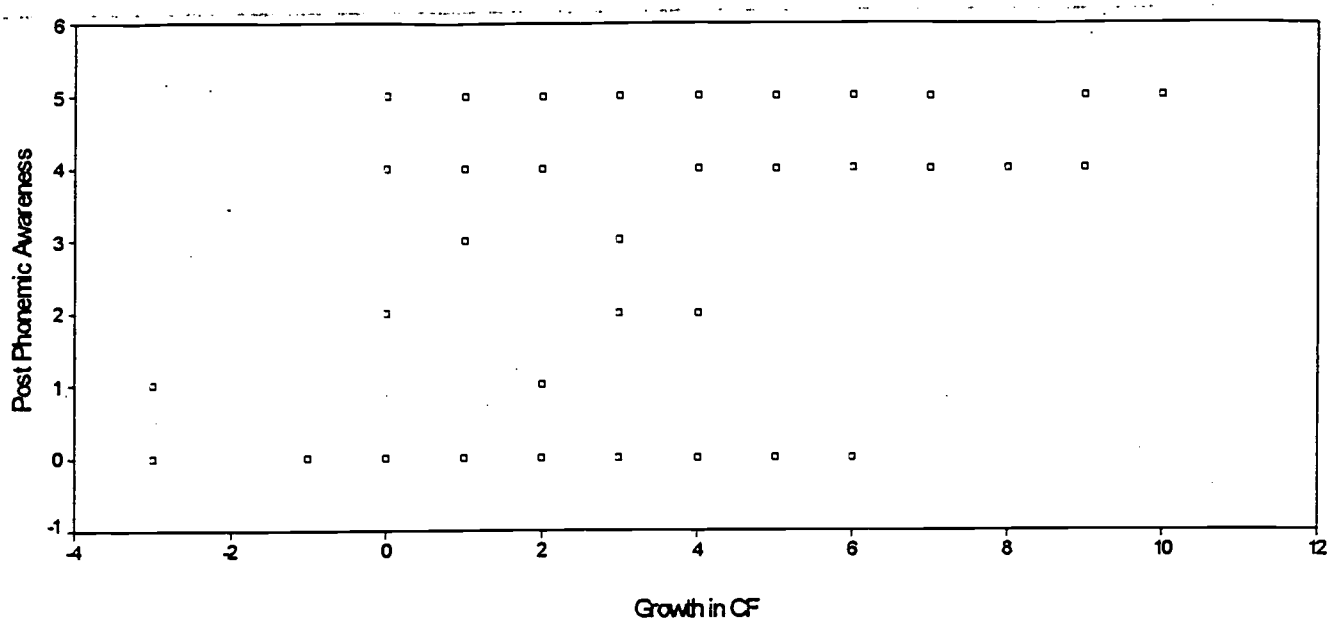


Source	SS	DF	MS	F	Signif of F
Group	27.7	1	27.7	2.87	.092
Within Cell	1834.8	190	9.66		
Time	69.02	1	69.02	11.56	.001
Group * Time	40.06	1	40.06	6.71	.010
Within Cell	1134.6	190	5.97		

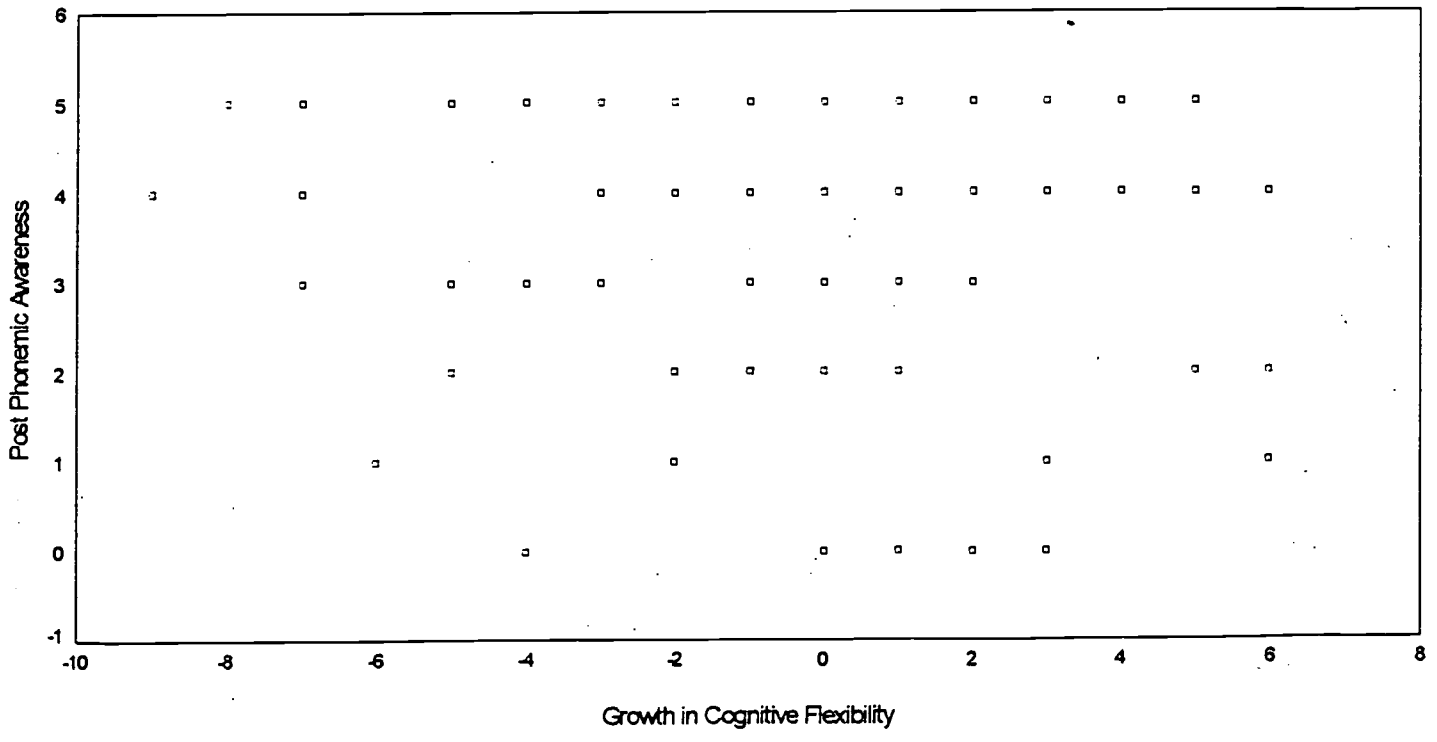
Association Between Post Phonemic Awareness Score and Growth in Cognitive Flexibility

Children low in initial CF



r=.36; p<.05

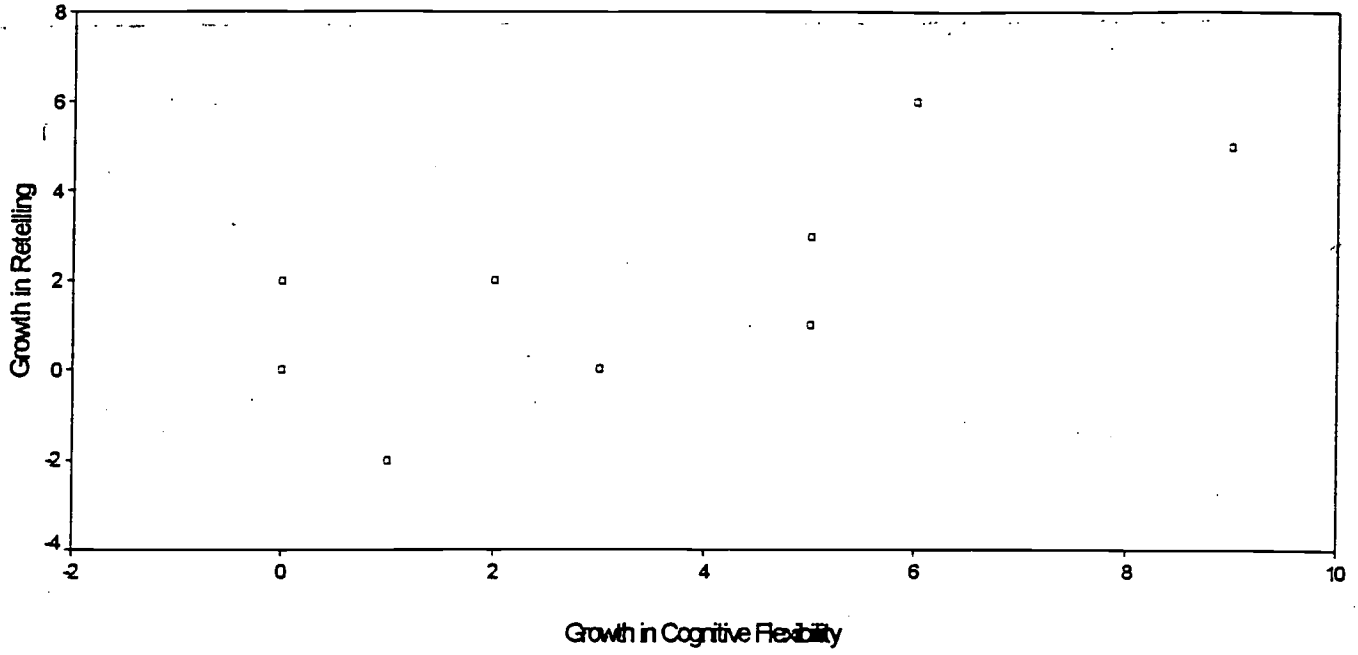
Children high in initial CF



r=-.08; p>.05

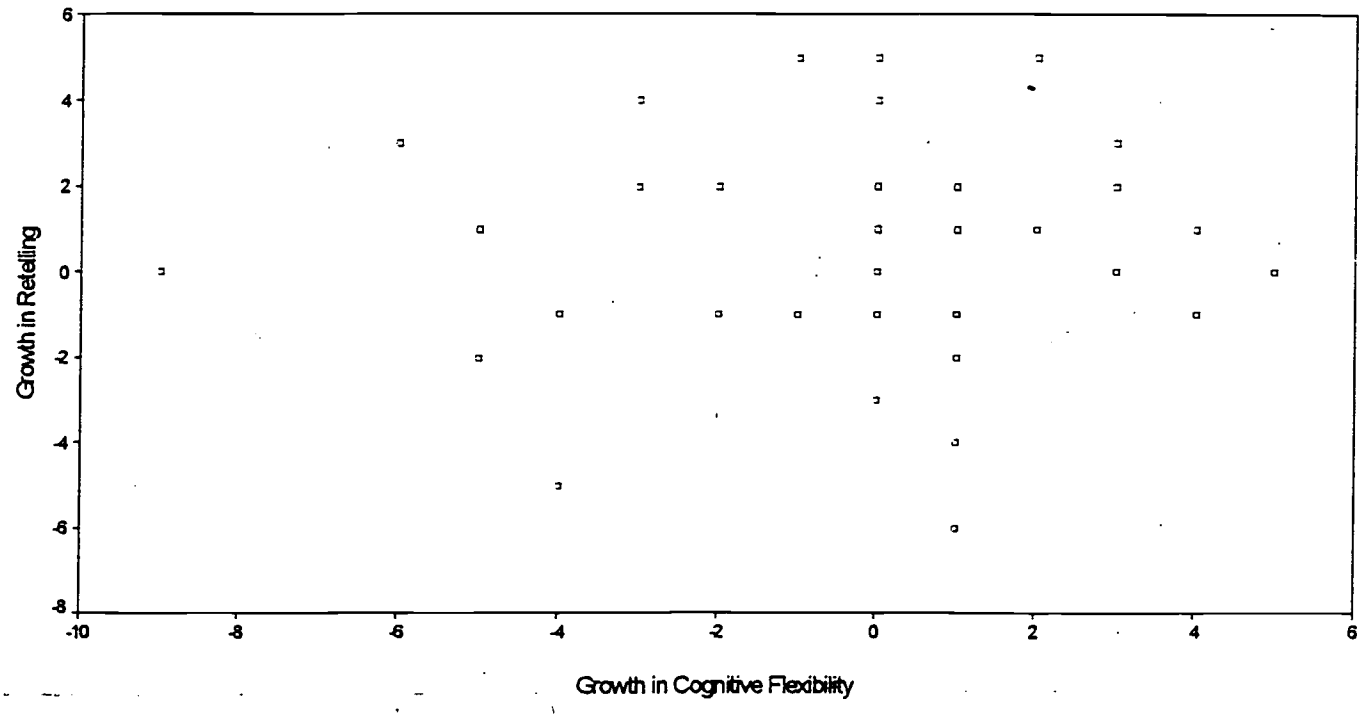
Association between Growth in Retelling And Growth in Cognitive Flexibility

Children Low in Initial CF



r=.74; p<.05

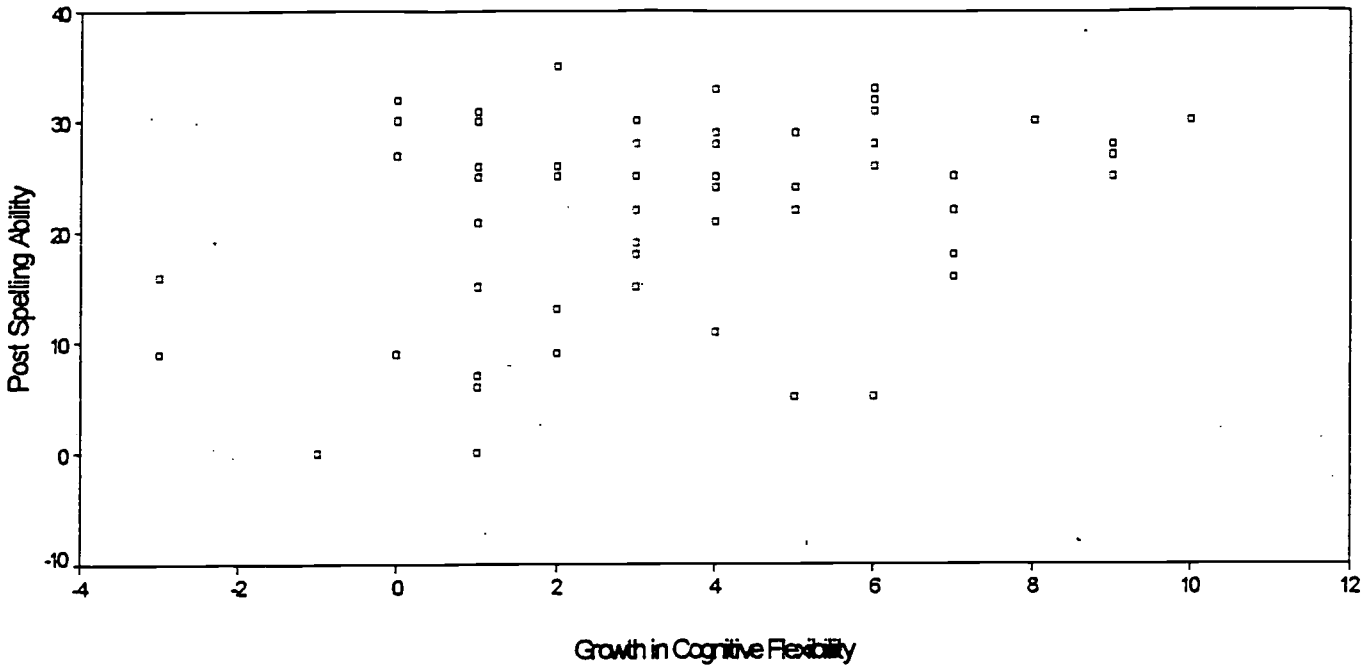
Children High in Initial CF



r=.05; p>.05

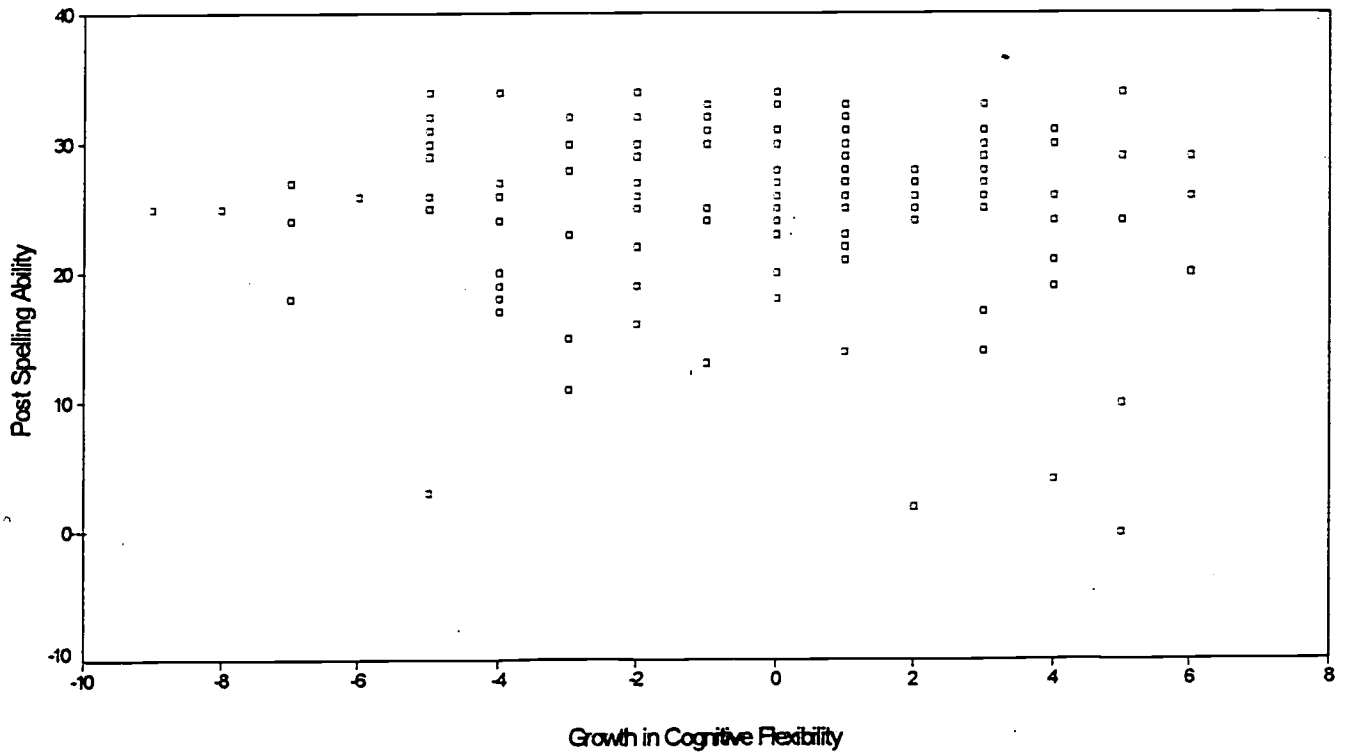
Association Between Post Spelling Score and Growth in Cognitive Flexibility

Children low in initial CF



r=.28; p<.05

Children high in initial CF



r=.06; p>.05

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